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The impact of nurses on patient morbidity and mortality – the need for a policy change in response to the nursing shortage

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Abstract

Context. Workforce projections indicate that by 2012 there will be a shortfall of 61 000 registered nurses in Australia. There is a growing body of evidence that links registered nurse staffing to better patient outcomes.

Purpose. This article provides a comprehensive review of the research linking nurse staffing to patient outcomes at a time of growing shortages, highlighting that a policy response based on substituting registered nurses with lower skilled workers may have adverse effects on patient outcomes.

Method. An electronic search of articles published in English using the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Journals @ OVID and Medline was undertaken.

Findings. Robust evidence exists nationally and internationally that links nurse staffing to patient outcomes. Recent meta-analyses have found that there was a 3–12% reduction in adverse outcomes and a 16% reduction in the risk of mortality in surgical patients with higher registered nurse staffing. Evidence confirms that improvements in nurse staffing is a cost-effective investment for the health system but this is not fully appreciated by health policy advisors.

Conclusions. An appropriate policy response demands that the evidence that patient safety is linked to nurse staffing be recognised. Policy makers must ensure there are sufficient registered nurses to guarantee patient safety.

What is known about the topic?

Projections indicate that by 2012 there will be an estimated shortfall of 61 000 registered nurses in Australia. However, research demonstrates the number of registered nurses caring for patients is critically important to

prevent adverse patient outcomes. Evidence also confirms that improvements in nurse staffing is a cost-effective investment for the health system.

What this paper adds? The paper exposes the lack of an appropriate policy response to the evidence in regard to nurse staffing and patient outcomes. It argues that patient safety must be recognised as a shared responsibility between policy makers and the nursing profession.

What are the implications for practitioners? Policy makers, health departments, Chief Executives and Nurse Leaders need to ensure that adequate nurse staffing includes a high proportion of registered nurses to prevent

Introduction

By 2012 there will be an estimated shortfall of 61 000 registered nurses (RNs) in Australia.¹ One response to this has been an exploration of alternative skill mix models.² Many healthcare agencies (acute, community and aged care facilities) have changed the mix of nurses, hiring more enrolled nurses and unregulated workers (assistants in nursing or healthcare assistants) and less RNs. However, these initiatives conflict with the growing body of evidence that links the role of RNs to patient outcomes, referred to as 'nursing sensitive outcomes'.³ This paper will review the literature in regard to the relationship between the number and mix of nurses and patient outcomes including mortality. Further, the review will establish the affordability of increases in the RN workforce and discuss the lack of understanding of this critical evidence by executives and doctors. Lastly, using the outcomes of the review the authors will expose a lack of a collective policy response in Australia to the evidence in the literature.

Method

For the literature review an electronic search was undertaken of articles published in English using the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Journals @ OVID and Medline dated from 1982 to 2005. A search for works by prominent authors in the field was also undertaken. The listed search terms from these publications also assisted in establishing search terms. Search terms included outcomes (healthcare), hospital mortality, personnel staffing, skill mix, nurse-patient ratio, workload, workload measurement, educational status, practice environment, patient classification methods and patient dependency. Once the initial search was undertaken, automatic weekly alerts were established to capture new publications using these search terms and key authors.

Nurse staffing and patient outcomes

A seminal study conducted two decades ago⁴ found that interaction and coordination amongst clinicians (medical and nursing staff) reduced patient deaths in ICU settings, but did not establish a link between nursing activities and patient outcomes. Since then a growing body of research indicates that RNs provide a continuous (24-h per day, 7 days per week) surveillance system for patients enabling the early detection and prompt intervention when their condition deteriorates.⁵ Nurses are in the best position to initiate actions that minimise adverse events and negative outcomes for patients.⁶ The effectiveness of nurse surveillance is influenced by the number and mix of nurses available to assess patients on an ongoing basis.^{6,7} In seminal work Needleman *et al.*

(p. xxiii)⁷ have identified several 'outcomes potentially sensitive to nursing (OPSN)', which they defined as:

a group of patient complications that had been established in the literature, which include urinary tract infections, skin pressure ulcers, hospital acquired pneumonia, and deep vein thrombosis or pulmonary embolism; a group of exploratory measures, comprised of upper gastrointestinal bleeding, central nervous system complications, sepsis, and shock or cardiac arrest; complications among surgical patients only, which included surgical wound infection, pulmonary failure, and metabolic derangement, and a final group consisting of mortality, two different measures of patient length of stay and failure to rescue, which was constructed as a death among patients with shock, sepsis, pneumonia, deep vein thrombosis or pulmonary embolism or gastrointestinal bleeding.

One example of how these outcomes relate to nursing can be found with hospital-acquired pneumonia, where two key risk factors are prolonged immobility, which leads to inadequate ventilation of parts of the lungs, and inappropriate or failure to perform pulmonary hygienic techniques. Nursing care influences both risk factors. More commonly now these patient outcomes are referred to as nursing (or nurse) sensitive outcomes. A great deal of research has been conducted linking a variety of nursing and staffing factors related to these outcomes: a summary follows.

The relationship between nurse staffing and patient outcomes

Early work established that higher levels of RN staffing, measured as RN hours per inpatient-day, were associated with improved patient outcomes.⁸⁻¹⁵ These included urinary tract infections and pneumonia after major surgery,

thrombosis and pulmonary compromise in surgical patients,⁹ pneumonia in elective and emergency patients,⁸ medication errors, pressure ulcers and patient complaints,^{10,11} mortality rates¹² and nosocomial infection rates.¹³ Other positive outcomes included better functional health outcomes, pain management and patients' perceptions of nursing care at discharge.¹⁴

The results strongly suggested that increased RN-to-patient ratios were inversely related to mortality rates; an increase in mean length of stay occurred with decreased staffing ratios; and higher staffing by RNs was associated with lower rates of unit-specific complications.^{12,15} However, there were several methodological concerns raised with respect to this early work. Many studies were undertaken at only one hospital or a small number and range of

units, resulting in small sample sizes and ambiguity over what constituted patient outcomes.¹⁵

Two landmark studies involving large administrative datasets provided more robust evidence and addressed many of the concerns identified above. The first study⁷ utilised discharge abstracts from 799 hospitals in 11 states of the

USA, providing a much larger sample size than any previous study. A second study⁵ used discharge data from over 200 000 patients at 168 adult general hospitals in Pennsylvania. Both studies found that lower RN staffing levels

adversely affected patient outcomes. In these studies^{5,7} 'failure to rescue' was a term used to describe a death from the complication of pneumonia, shock or cardiac arrest, upper gastrointestinal bleeding, sepsis or deep vein

thrombosis. Needleman *et al.*⁷ found that a higher proportion of hours of care per day and the absolute hours of care provided by RNs were associated with a shorter length of stay, fewer urinary tract infections, less gastrointestinal bleeding, lower rates of pneumonia, shock or cardiac arrest and lower rates of failure to rescue in medical patients.

In surgical patients, a higher proportion of care provided by RNs was linked with less urinary tract infections, and a greater number of hours of care per day provided by RNs was linked with lower rates of failure to rescue.⁷

Aiken *et al.*⁵ found that each additional patient added to a nurse's workload was associated with a 7% increase in the likelihood of dying within 30 days of admission and a 7% increase in the

likelihood of failure to rescue (the results were risk adjusted for patient and hospital characteristics). Both studies concluded that substantial decreases in mortality rates would occur if there were increased RN staffing.

This growing body of evidence was initially dismissed at a policy level internationally as the work was conducted in the United States where the care system was different from most other industrialised countries. However, since that time, similar large scale studies conducted in England,¹⁶ Canada^{17,18} and Australia^{19,20} have demonstrated similar relationships.

The Canadian study¹⁷ found mortality rates from 18 142 patients in 49 acute care hospitals in Alberta varied significantly across hospitals. Age and patient co-morbidities explained 44.2% of the variation whereas four nursing factors explained a further 36.9%. The first of these nursing factors was the level of nurse education. Hospitals with a higher proportion of baccalaureate-prepared (4 year degree) nurses had lower rates of 30-day mortality, also

consistent with Aiken's findings.⁶ The second factor was skill mix: Hospitals with a higher proportion of RNs had lower rates of 30-day mortality. The third factor was employment status: Hospitals with a higher proportion of casual and temporary nurses were associated with higher rates of 30-day mortality. The fourth factor was nurse-physician

relationships: Hospitals with higher scores on collaborative nurse-physician relationships had lower rates of 30-day patient mortality. More recently, Tourangeau *et al.*¹⁸ have found that higher percentages of RNs, higher percentages of baccalaureate-prepared nurses, more nurses reporting adequacy of staffing and resources were also associated

with lower 30-day mortality rates in medical patients.

A UK study¹⁶ that involved 30 acute care trusts, also found consistently better outcomes for patients in hospitals that had higher nurse-to-patient ratios compared to those with less favourable staffing. The patients in better staffed hospitals had lower rates of surgical mortality and failure to rescue. Patients in hospitals with the lowest nurse-to-patient ratios had a 26% higher mortality. The authors calculated 246 fewer deaths would have occurred in

the subset of surgical patients if all patients were treated in hospitals with the most favourable nurse staffing levels.¹⁶

The only Australian studies^{19,20} to examine the relationship between nursing hours of care and the proportion of hours of care provided by RNs found similar results. Hospitals that had a skill mix with a higher proportion of RN hours produced statistically significant decreased rates of decubitus ulcers, gastrointestinal bleeding, sepsis, shock,

physiologic or metabolic derangement, pulmonary failure, failure to rescue and falls.¹⁹ These same authors found in

a parallel study²⁰ that increasing RN hours by 10% decreased the following adverse events central nervous system complications (45%), gastrointestinal bleeding (37%), urinary tract infections (34%), failure to rescue (27%), decubitus ulcers (19%), sepsis (15%) and pneumonia (11%).

In addition to these country specific studies, several systematic reviews of the literature have recently been undertaken, each reporting similar findings. Stanton²¹ concluded that there was a 3–12% reduction in adverse outcomes (falls, urinary tract infections, upper gastrointestinal bleeding, pressure ulcers, pneumonia, failure to

rescue, and nosocomial infections) with higher RN staffing levels. A second review concluded that increased patient

mortality, failure to rescue, respiratory tract infection and decreased quality of care were significantly related to high nursing workload.²² By contrast, increased total hours of nursing time were associated with improvements in patient outcomes such as lower pressure ulcer rates, lower mortality rates,²² fewer medication errors,³ reduced length of stay, as well as reductions in the incidence of injuries and falls. Finally, Kane *et al.*³ summarised evidence that concluded that higher RN-to-patient ratios were associated with reduced mortality, failure to rescue and length of stay. Furthermore, Kane *et al.* found that every additional RN Full Time Equivalent (FTE) per patient-day was associated with a 16% reduced risk of mortality in surgical patients. Conversely, every additional patient-to-RN per shift was associated with a 7% increase in pneumonia, a 53% increase in pulmonary failure and a 17% increase in medical complications. In contrast, the death rate decreased by 1.98% for every additional nurse-hour per patient-day.

In summary, as the body of knowledge about nursing sensitive patient outcomes has expanded there can be no doubt the hours of care and skill mix (hours of care provided by RNs) do affect patient outcomes. Increased nursing hours and more hours of care provided by RNs have been shown to decrease patient mortality and adverse patient outcomes.⁵⁻²²

Affordability of additional RN staffing

Although the evidence strongly supported the link between an increase in nurse staffing and a higher proportion of RNs to improvements in the quality of care,²³ questions arose as to whether or not these staffing models were affordable. In response, Needleman *et al.*²³ utilised data from 799 hospitals to argue a business and social case for investing in nurse staffing. They analysed the costs of increasing nurse staffing to the 75th percentile for hospitals below this level to determine cost savings achieved by reduced length of stay and decreased adverse outcomes. The authors estimated from the data that increased nurse staffing could avoid 6700 inpatient hospital patient deaths; three-quarters of those from a richer RN mix, which also resulted in significant cost savings.

A second report²⁴ based on Michigan (USA) data suggested that reducing the number of adverse outcomes by increasing nurse to patient ratios resulted in significant savings. For example, estimated savings of US\$22.03 million per year for Michigan hospitals related to prevention of pneumonia and US\$5.8 million per year related to nosocomial infections were possible.²⁴ Data were also used to model the impact of staffing changes on patient outcomes. The estimated savings in adverse patient outcomes in a typical 200-bed hospital that moved from a 1-to-5 nurse-to-patient ratio over a 10-year period to a 1-to-4 ratio was US\$7.5 million in the first year and more than US\$11 million by year 10.²⁴ Rothberg, Abraham *et al.*²⁵ found increasing the nurse-to-patient ratio to 1-to-4 from 1-to-8 would save additional lives at a cost of US\$136 000 per life saved. This constituted a considerable saving compared to the cost of thrombolytic therapy in acute myocardial infarction at US\$182 000 per life saved or routine cervical cancer screening at a cost of US\$432 000 per life saved. Similarly, Cho²⁶ has found the costs of hospital-acquired pneumonia to be US\$22 390–\$28 505 per episode. These

studies²³⁻²⁶ clearly support the proposition that to increase RN hours of care is cost effective as it improves patient outcomes but is also affordable.

Understanding of the evidence by doctors and hospital executives

Although research indicates that employment of an adequate number and mix of RNs achieves better patient outcomes and is cost effective, the importance of nurse staffing to patient outcomes is not readily understood by medical staff or chief executive officers.²⁷ In a national US survey of RNs, physicians and hospital executives, significantly fewer physicians and chief executive officers than RNs believed the nursing shortage had an adverse impact on patient safety, early detection of patient complications or time for team collaboration. Twice as many RNs as physicians thought that the shortage of nurses had adversely affected patient safety. The majority of RNs and chief nursing officers expressed concern about the impact of shortages on the early detection of patient complications and nurses' ability to maintain patient safety. The majority of chief executive officers and physicians did not share this view, suggesting that chief executive officers and medical staff do not associate nurses and their work with patient safety. In addition, they did not appreciate the impact nurses had in detecting complications or rescuing the patient before their condition deteriorated and their lives were put at risk. Although similar studies have not been conducted in Australia, there is no reason to think views would be starkly different to these.²⁷ The safety of hospital patients remains a shared responsibility amongst the health professions²⁷ and as the views of senior clinical staff and chief executive officers influence health policy, it is essential that informed decisions are made, decisions based on the evidence.

Workforce shortages

A further challenge in providing adequate nurse staffing and a richer RN mix is the nursing shortage. Workforce projections in Australia, particularly for nursing, are grim. In 2000 an estimated 170 000 new people entered the workforce per annum but by 2020 this number is expected to drop to 12 500 per annum²⁸ and there will be an

estimated shortfall of 61 000 nurses.¹ Although demand is growing the current supply is just meeting replacement needs. Of equal concern is that the nursing workforce is aging more rapidly than others²⁹ with the average age rising from 42.2 in 2001 to 45.1 years in 2005.³⁰ The proportion of nurses aged 50 years and older increased from 24.4 to 35.8%.³⁰ Consequently, over the next decade more than one third of the Australian nursing workforce is likely to retire. These trends indicate Australian health care services will face significant challenges in securing adequate nursing resources (both hours of care and RN skill mix) to provide safe and effective patient care. In part these shortages have been exacerbated because RNs perceive³¹ their workload has increased as the skill mix has changed, leading to a greater likelihood of them leaving.

Policy response

The demonstrated relationship between nurse staffing, and in particular the role of RNs in improving patient outcomes, requires a collaborative policy response to not only increase the number of nurses in the workforce but more importantly, to increase the proportion of RNs employed. However, the reality is that the exact opposite is occurring. Calls for greater workforce flexibility and skill mix changes have resulted in substitution of more highly skilled workers with assistant type roles⁶ rather than maximising use of the skills and expertise of the RN workforce to enhance patient safety. This workforce trend has overlooked the evidence supporting improved patient outcomes when health services have more hours of care provided by RNs. In addition, the number and diversity of key players at both state and federal levels involved in workforce planning, education, training and accreditation make it difficult to achieve a coordinated policy response.² This diversity of stakeholders results in fragmentation of responsibilities, ineffective coordination between sectors and inefficiencies in funding and payment arrangements. Effective and efficient policy responses in this climate are difficult, for example coordination of the number of university places made available for nurse education.

If governments are serious about reducing the number of patient deaths, then government policy should focus on initiatives aimed at maximising the number of RNs at patients' bedsides.³² Current thinking about new models of care that maximise the use of less skilled workers to assist in patient care is not congruent with evidence to hand.⁶

RNs are a critical part of the healthcare team and the number of RNs in the team is directly linked to patient safety. Policy responses should also support the determination of safe levels of nurse staffing, including the mix of nurses, by funding studies to empirically examine specific nurse staffing methods. Recently in New Zealand a component of the national multi-employer collective agreement³³ was to establish a safe staffing commission to assess the impact and implications of low staffing levels, nursing workload, and to create guidelines on safe staffing and healthy workplaces. Addressing the global nursing shortage crisis requires partnerships involving all sectors, actively engaging stakeholders to implement, monitor and evaluate effective policy interventions and strategies to attract and retain nurses, especially RNs, into the health workforce. In Australia, the Australian Commission on Safety and Quality in Health Care³⁴ recently published a proposed list of 58 indicators by which hospital performance would be assessed. Unlike the United States, nursing skill mix was not one of the indicators.

In conclusion, this paper has highlighted the important role of nurses in providing a continuous surveillance system enabling the early detection and prompt intervention when patients' conditions deteriorate.⁵ The ability of nurses to initiate actions that minimise adverse events and negative outcomes for patients⁶ is directly linked to the hours of care and the skill mix (proportion of RN hours worked) and has been shown to be cost effective and affordable.^{23–26}

Although Australia is facing significant nursing shortages that are predicted to worsen over the coming decade, the policy response to the nursing workforce shortages to date have been inadequate. Strategies relying on substitution with less skilled workers^{2,35} is in direct contrast to the evidence.^{1,28,30}

Competing interests

No conflicts of interest exist.

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